

COLORADO DEPARTMENT OF HEALTH
AND
U.S. ENVIRONMENTAL PROTECTION AGENCY
COMMENTS:

DOCUMENT REVIEW;
TECHNICAL MEMORANDUM 1
TO FINAL PHASE I RFI/RI WORK PLAN

VADOSE ZONE INVESTIGATION
SOLAR EVAPORATION PONDS OU4

U.S. Department of Energy
Rocky Flats Plant
Golden, Colorado

December 18, 1992

CDH COMMENTS:

COMMENTS ON DRAFT FINAL TECHNICAL MEMORANDUM (NO. 1) VADOSE ZONE INVESTIGATION (Addendum to Final Phase I RFI/RI Work Plan) FOR SOLAR EVAPORATION PONDS OU4

COMMENT 1. COVER: For record-keeping purposes, this TM should be retitled as follows: Technical Memorandum No. 1, to Final Phase I RFI/RI Work Plan, Solar Evaporation Ponds, Operable Unit No. 4, U.S. Department of Energy, Rocky Flats Plant, Golden, Colorado, etc. with the date. Although the Executive Summary references the RFI/RI, the current title does not. Numbering TMs as they are developed will prevent filing problems and enable all parties to more conveniently reference the specific document.

RESPONSE The TM cover has been modified as requested.

COMMENT 2. Section 1.0: The claim is made once again that the "hydrostratigraphic units" at Rocky Flats are not aquifers. 6 CCR 1007-3 does not provide for the definition of "aquifer" as stated here; thus, these "hydrostratigraphic units" must be considered aquifers. DOE must come to an understanding of the requirements of the Colorado Hazardous Waste Act and its implementing regulations in regard to this definition.

RESPONSE The text has been modified to eliminate the comparison of designated hydrostratigraphic units with aquifers.

COMMENT 3a. Section 1.3.1: In reference to the fourth bullet, page 1-7, the "lower confined HSU" may be impacted by the uppermost unconfined hydrostratigraphic unit. The Arapahoe and Laramie Formations are truncated to the north and are in contact with Rocky Flats Alluvium and colluvium. Also, the french drain system, if tied into sandstone bedrock, may further impact the lower HSU. The Division brings these concerns to DOE's attention because, as stated in the opening paragraph, the information is "being used to guide the placement of boreholes and determine what data must be generated at each specific location." Please determine whether these observations affect your rationale for the proposed investigation plan.

RESPONSE Several factors indicate that the upper and lower hydrostratigraphic units are not in direct communication. The siltstones and claystones of the Arapahoe and Laramie formations are limited in their ability to conduct ground water, particularly in the vertical direction, as

documented by hydraulic testing. More permeable sandstones are discontinuous and limited in extent. Seepage on the hillside where upper and lower units may be in contact is most likely indicative of discharge from, rather than recharge to, the lower hydrostratigraphic unit. In addition, lower hydrostratigraphic unit wells within the OU4 area indicate the absence of contaminants.

Low permeability, unweathered bedrock materials were not excavated during construction of the ITS, and minor excavation of uppermost weathered bedrock is unlikely to significantly increase downward migration. Decreasing the hydraulic head in the uppermost weathered bedrock, as a result of proper ITS functioning, will instead decrease the potential for downward migration. These considerations have influenced placement of borings within the OU4 area, as discussed in Section 2.2.4 of the Final TM.

COMMENT 3b.

Although caliche, beginning at a depth of approximately three feet, is evident from Solar Ponds area drilling (Phase I RFI/RI Work Plan, Appendix B), no specific discussion is provided. Since the bottoms of the solar ponds appear to have been constructed below this caliche horizon, does this information warrant alteration or variation in the proposed investigation plan. The Division, for example, notes the proposed use of the Guelph permeameters in the 0-2 foot zone. The Division is more concerned about the permeability beneath each of the ponds; if the caliche is absent as a result of pond excavation, the Guelph devices may not be appropriate. Please verify the need for the Guelphs and demonstrate that permeability beneath the ponds is being specifically investigated particularly if angle versus vertical drilling is employed. For example, can BAT® and lysimeters be utilized in angled boreholes?

RESPONSE

Low permeability layers such as the caliche occur within the vadose zone, and their effects on downward infiltration must be evaluated. Permeabilities of both surface and subsurface alluvial sediments are required to evaluate mobility of vadose zone flow. Permeability measurements both at ground surface and beneath the pond liner using the Guelph permeameter are proposed as a means of documenting variability in vadose zone hydraulic characteristics. In addition, borehole permeabilities of deeper soils will be measured in the field using the BAT® system and in the laboratory using standard geotechnical techniques. Instrumentation required for the proposed program is capable of being installed in boreholes angled up to 45 degrees from the vertical.

COMMENT 3c. **Bullet 7:** Care should be taken to have valid reasons such as bedrock highs, dry wells, or small saturated thickness before assuming an area dry. Well constructions should also be checked for problems.

RESPONSE Proper functioning of the ITS is the most likely reason for this dry area, as discussed in Section A.4. Review of existing data is continuing, and Phase I RFI/RI borings have been proposed for this area.

COMMENT 4. Section 2.2.1: Was a detailed soils map overlooked in the data listing? Known contamination distribution patterns should be used with care as they may be biased by opinions about the hydrogeology.

RESPONSE A soils map has been added to the listing of data sources, and the appropriate reference is provided in Section 4.0.

COMMENT 5. Section 2.2.3: **Bullet 8:** Good point, do not overlook effects of previous saturation.

RESPONSE Thank you.

COMMENT 6. Section 2.2: What methods were used to determine how and where the proposed boreholes would be placed?

RESPONSE The text has been expanded significantly to discuss the existing data evaluation program, particularly within Appendix A. Locations of each vadose boring have been reviewed, and in several cases modified, as discussed in Section 2.2.4.

COMMENT 7. Section 2.2.4: Four of the proposed vadose zone boreholes are located within the perimeter of Pond 207C and the 207B ponds. Since water and sludge remain in these ponds and angle drilling may be the only timely solution for borehole completion, can the angle drilled holes accommodate borehole dependent vadose zone efforts?

RESPONSE Angle drilling in Ponds 207C, 207B-North and 207B-South is currently being considered. Instrumentation of the type proposed in this TM has been successfully installed in angled boreholes at the sludge drying beds. A maximum borehole angle of 45 degrees from the vertical may be used for installation of the proposed instrumentation.

COMMENT 8a. Section 2.2.5: Reference is made in the last paragraph of page 2-9 to physical and hydraulic measurements of soils cores. Since vadose zone "soils" are expected to be unconsolidated or loosely consolidated material, physical alteration of the cores seems probable. Disaggregation of the core probably will occur long before it is planned. Other approaches to obtaining data should be considered.

RESPONSE The vadose zone program relies on both laboratory and field techniques for measurement of physical and hydraulic properties. Physical and hydraulic measurements will be conducted on intact samples collected within a core barrel liner using established and accepted geotechnical procedures. Some of the lab procedures, including grain size analysis, actually require disaggregation. Field procedures for estimation of moisture content, matric potential and permeability have also been proposed as a means of verifying the lab measurements.

COMMENT 8b. In the last paragraph, page 2-10, what constitutes a "significant hydrogeologic unit?" Since it is stated earlier in the report that there are no significant hydrogeologic units, Rocky Flats needs to define this clearly or retract the initial statement.

RESPONSE The text has been modified to require collection of samples at predefined intervals, rather than at significant hydrogeologic units, while still allowing collection of additional samples of opportunity based on field observations.

COMMENT 9. Section 2.2.6: The geometric mean listed for Rocky Flats Alluvium may be a little low. Not all hydraulic conductivity values in the plant database have been validated.

RESPONSE These data were taken directly from the 1986 Part B application (Rockwell, 1986). Although all of these data may not have been validated, they are still of use in developing an initial understanding of site conditions. Additional measurements collected during this investigation will supplement these existing data.

COMMENT 10a. Section 2.2.7: The use of Guelph permeameters is of concern as discussed under Section 1.3.1 above.

RESPONSE The program has been modified to include Guelph permeameter measurements beneath the pond liners where caliche may not be present. Other methods for characterization of subsurface alluvial materials are also provided.

COMMENT 10b. Under Moisture Profiles, page 2-14, in order to complete this investigation in a timely fashion some consideration might be given to creating an appropriate precipitation event.

RESPONSE OU2 is currently implementing an investigation which includes a simulated precipitation event. The double ring infiltrometer measurements will provide similar data regarding infiltration characteristics in the OU4 area.

COMMENT 11. Section 2.2.9: A statement is made in this section that assumes "appropriate precipitation, evaporation, transpiration, and run-off data are available" to support water balance calculations. This should not be assumed; DOE must research this issue to verify availability of such data or devise a plan component to acquire the needed data.

Although construction of a water balance for the facility is needed and can be refined by addition of the vadose zone knowledge, an initial balance has already been done for the area. What should be done via this system is a refining of that balance, rather than a reconstruction of the entire equation. A new balance should be constructed only if it can be shown that the older equation cannot be modified to include the vadose zone.

RESPONSE A compilation of precipitation, evaporation transpiration, and runoff data for the RFP, and the OU4 area in particular, was prepared during the Zero Offsite Water Discharge Study. Water balances for the RFP and the solar ponds/ITS area were also prepared during this investigation. The OU4 RFI/RI will use these existing water balances as an initial estimate of site conditions, and then refine the vadose zone storage and transmission portions of the existing water balance using new data collected during the vadose zone field investigation.

COMMENT 12. Section 2.2.12: Regarding page 2-20, if literature investigations do not turn up adequate information on the sorption characteristics of plutonium and americium is there consideration of performing tests with Rocky Flats soils?

RESPONSE An investigation of americium and plutonium mobility in RFP soils is currently being conducted under OU2. The project team has developed an extensive data base regarding the mobility of radionuclides in the environment. Both the site-specific RFP and general literature sources will be used to estimate behavior of these contaminants within OU4 soils.

COMMENT 13: Section 2.3: Regarding SOP approval, page 2-23, EPA and the Division must approve SOPs under the terms of the IAG, Statement of Work, Section IV. SOPs are a part of the Sampling and Analysis Plan.

RESPONSE The text has been modified accordingly.

COMMENT 14: Table 2.1: This table suggests one BAT® test per borehole; however, text in Section 2.2.6, page 2-12, indicates, as the Division would expect, that more than one lithologic unit per borehole will be encountered and tested. Please amend Table 2.1 to reflect the probability of multiple BAT® tests per borehole.

RESPONSE The table and text have been modified accordingly.

COMMENT 15. Figure 2-1: Work Element 4 is a decision point to determine whether enough data has been obtained to proceed with Work Elements 10 through 15. Section 2.2 does not discuss how this decision will be made. Ultimately, the adequacy of the data and conclusions will be decided by EPA and the Division upon delivery of the RFI/RI Report; however, an interim decision by DOE on when enough data is available to calculate Water Balance, for example, should be determined early on to minimize the need for a second round of data collection. The decision ideally should be made while the work is "in the field" rather than when DOE begins to run calculations and draw conclusions. Please discuss Work Element 4 in Section 2.2 to show how and when this decision will be made.

RESPONSE The approach has been modified to include the initial data evaluation activities conducted to date. The investigation, as currently proposed, has been designed to address perceived information deficiencies regarding flow of water and migration of contaminants in the OU4 vadose zone. Resulting data will be analyzed and incorporated into the three dimensional geologic model and the Solar Ponds/ITS water balance, and will be presented in the Phase I RFI/RI Report. Subsequent deficiencies noted by the agencies during the review and comment process will be considered under later phases of investigation.

COMMENT 16. Figure 2-3: The conceptual model does not show what is alluvium or bedrock. Is the french drain keyed to bedrock? Does this work plan include searching for perching layers below those keyed into the french drain?

RESPONSE The conceptual model schematic has been revised to more accurately reflect our current site understanding. As discussed in Section A.4,

the ITS is keyed into bedrock over most of its extent. The Phase I RFI/RI investigation includes unconsolidated source/soil materials down to the bedrock interface. Later investigation phases will target underlying bedrock units.

COMMENT 17. Section 3.0: A timeline showing the "time-sensitive" elements for implementing this system should be provided in this document. Some comparison of how this particular investigation will affect any other investigations which may be ongoing in the area, as well as any scheduling impacts due to normal operations or time and security constraints, should be included in the schedule.

RESPONSE A draft OU4 schedule has been included in Appendix C of the final document.

COMMENT 18. Appendix A: Regarding page A-2, bullet 3, packer tests are not performed on alluvial materials. Sentence on geometric means of hydraulic conductivities probably includes sitewide data. Decide which information is pertinent to discussion.

RESPONSE The text has been revised accordingly. Sitewide data provide an excellent means of evaluating the relative differences in hydraulic properties of geologic materials at RFP and formulating opinions regarding the extent of alluvial-bedrock interactions. These sitewide data will be refined by the current OU4-specific investigation.

COMMENT 19. Appendix B: The SOPs appear, on first reading, to be vague with perhaps too much reliance on instrument manuals. The Division would prefer that SOPs set forth a procedure as fully as possible and that use of instrument manuals be for reference purposes when problems or difficulties arise. Routine operation should be explained in the specific SOP to minimize the chance of field personnel "winging" the protocols.

Furthermore, the Division recently received draft SOP GT.22 for the BAT® System and GT.31 for Soil Measurement Systems™ Tensiometers. These SOPs appear to be more instructive than those in the TM. Also, two SOPs for the same device are inappropriate (unless VZ.3 is for a different make of tensiometer). Please determine which SOP(s) is appropriate and amend those SOPs that are heavily reliant on the instrument manuals (VZ.8, for example).

RESPONSE The SOPs provided in draft final Appendix B have been modified, expanded, or deleted from the final document, as appropriate. Any required changes to existing SOPs will be accomplished as Document Change Notices.

COMMENT 20. SOP VZ.6: The formula in Section 5.4 needs an equals sign following M_s . More importantly, the procedure for determining water content must be discussed. If necessary, provide a new SOP to discuss the procedure.

RESPONSE The equation has been modified as requested. Water content will be determined as a laboratory analyte using EG&G analytical protocols.

EPA COMMENTS:

DRAFT TECHNICAL MEMORANDUM VADOSE ZONE INVESTIGATION FOR OU4

COMMENT 1a. Overall this vadose zone investigation program included the appropriate techniques for characterization of the vadose zone at the solar ponds. However, the program failed to provide a basis for the number and location of the proposed monitoring stations. EPA feels that this is crucial to the success of the program. A more thorough Data Quality Objective (DQO) development process which includes a clear statement of the question(s) to be answered and justifies, either statistically or otherwise, the field investigation's scope needs to be performed and presented. This will ensure that the amount of the data gathered and its quality are adequate and appropriate to meet the program objectives.

RESPONSE A discussion of the initial data evaluation effort, as well as justification for individual borings, has been added to the document. The use of data in refining an existing water balance and evaluating long-term monitoring methodologies has been clarified, and intermediate data quality decision points have been eliminated from the program. The Data Quality Objectives section of the report has also been modified.

COMMENT 1b. Justification for selecting 16 of the 49 borehole locations proposed in the Phase I RFI/RI Work Plan, for this vadose zone investigation. The reason for choosing the 16 locations should be directly to the objective of this study. Specifically, the locations should be related to the description of potential vadose zone materials that must be investigated listed on pages 2-6 and 2-7 of the vadose zone memo.

RESPONSE The justification for boring locations has been added to the final TM in Section 2.2.4, and is based on the initial data evaluation presented in Appendix A. Proposed locations are based on the potential pathways listed in Section 2.2.3, as requested.

COMMENT 1c. The 25 locations for the Guelph permeameter tests should be correlated to the four types of shallow soils known to exist in the OU4 area. These four soil types are listed on page 2-12 of the vadose zone memo. In addition, a map illustrating the Guelph permeameter locations should be provided.

RESPONSE A location map for Guelph permeameter testing has been added to the text. The Soil Conservation Service soil map is currently being renewed to evaluate the soil series' present prior to disturbance and construction. Insufficient information is available to map the

disturbed soil types known to occur within the OU4 area. However, the relatively uniform distribution of testing locations should be representative of the range of soils present within the OU. Several varied tests at immediately adjacent locations have also been indicated to allow later comparison of variability as a function of distance.

COMMENT 1d. Further explanation of how the Guelph permeameter data will be used to guide the placement of the double ring infiltrometers. Page 2-13 states that only areas of low variability will be chosen. The criteria for determining what Guelph permeameter results indicate low variability should be provided.

RESPONSE Selection of locations for double ring infiltration tests may be constrained to a large degree by site logistics. While at least one location within the ponds is considered desirable to represent conditions within the primary source area, pond operational requirements may eliminate this installation as a possibility. Other areas on the hillside north of the ponds, which may act as continuing secondary sources of contaminants, are too steep for infiltrometer installation. Level areas around the ponds where adequate clearance exists may be the only logistically feasible locations for the infiltrometer investigation. Further consideration will be given to this issue as field work proceeds and site conditions are better understood.

COMMENT 1e. Three areas of OU1 have been chosen for the soil gas survey. Two of the areas, original earthen ponds and upgradient area are not illustrated on Figure 2-2. These areas should be shown so that sample location choice can be verified.

RESPONSE Areas attributed to the soil gas investigation at the original earthen ponds, 207B-series ponds, and upgradient area are indicated in Figure 2-4 of the final TM, which also identifies the proposed soil gas sampling locations.

COMMENT 2. There appears to be a lack of coordination between this program and the overall clean-out project of the solar ponds. This program has been designed assuming complete removal of pond water and sludge. To date, there has not been a final decision made on the disposition of the sludge. Therefore, changes in the number and location of the proposed monitoring stations may be needed. This program needs to contain sufficient flexibility to adjust to future management decisions on the overall solar ponds programs.

RESPONSE Changes in the location of proposed monitoring activities may indeed be required based on logistical constraints. Angled drilling is currently being considered for the 207C, 207B-North, and 207B-South ponds. Specifically, the elevations of bedrock, water table, and pond

bottoms will be determined from existing data, as well as initial OU4 Phase I RFI/RI borings located around the ponds. Vadose zone thickness will be calculated from these data. Angled drilling techniques will be reviewed to evaluate the lateral distance under the ponds that can be achieved for a given borehole angle and vadose zone thickness. Advantages and disadvantages of drilling from pond berms and from outside of the berms are being investigated. The potential for changes in boring locations based on logistical and technical considerations has been identified in the text of the final TM.

COMMENT 3. The schedule for implementation of this vadose zone investigation is not provided. Instead page 3-1 states that the actual schedule will be incorporated into the OU4 Phase I schedule when the tech memo is approved. For consistency, a preliminary version of the schedule should be included in this tech memo.

RESPONSE A preliminary timeline has been incorporated in Appendix C of the Final TM.

COMMENT 4. The final RFI/RI Work Plan for OU4 states that specific vadose zone techniques may be tested in a pilot program. A test program is not mentioned in this technical memorandum.

RESPONSE Most of the instrumentation described in the TM is considered exploratory in nature, and the actual effectiveness of each measurement technique in the solar ponds area is uncertain. Redundancy has been built into the program to address this uncertainty. Efficiency of each of the techniques used will be evaluated at the end of the Phase I RFI/RI program, and recommendations will be provided regarding the most promising methods for long term monitoring.

2.0 SPECIFIC COMMENTS

COMMENT 1. Page 2-10, Section , Paragraph 3. Organic carbon content and cation exchange capacity will only be measured in samples from significant hydrogeologic units. A definition of significant hydrogeologic unit should be provided.

Rationale: As currently written, the vadose zone memo does not provide enough information to direct the field sampling crew.

RESPONSE A uniform sampling interval has been indicated for collection of organic carbon and cation exchange capacity samples. Additional samples may be collected based on the judgement of the field geologist.

COMMENT 2. Page 2-12, Section 2.2.6, Paragraph 2. The BAT® system of borehole permeability tests will be used when units of concern are encountered in each borehole. The definition of units of concern should be listed.

Rationale: The term unit of concern is too vague to be used to direct the field effort.

RESPONSE A uniform sampling interval has been specified in the text, with the added flexibility to adjust these intervals as necessary based on field observations.

COMMENT 3. Page 2-18, Section , Paragraph 4. No information is provided which describes how an appropriate suite of gas analytes will be chosen during the initial stages of the soil gas survey. It would seem more appropriate to initially analyze for a wide spectrum of analytes and then provide a rationale for eliminating analytes. Further explanation of the soil gas analytes is required.

Rationale: Soil gas analytes should be specified prior to starting field work so that reviewers have an opportunity to check the analyte list.

RESPONSE Four volatile organic compounds have been selected as target analytes based on their frequency of use in RFP operations. These analytes include carbon tetrachloride, trichloroethane, trichloroethylene, and tetrachloroethylene. Although organic wastes were specifically segregated from the process wastewater stream, these volatiles are most likely to be present in plant wastes due to the large volumes used on plant-site. Later soil and vadose water analysis will determine a full suite of volatile aromatic and volatile organohalogen compounds.

COMMENT 4.

Figure 2-2. This figure illustrates the locations of the vadose zone investigations. However, none of the 25 Guelph permeameter locations are illustrated and 2 of the double ring infiltrometer locations are. This does not make sense because double ring infiltrometer locations will be based on the Guelph permeameter results. Figure 2-2 should be corrected to show Guelph permeameter rather than double ring infiltrometer locations.

Rationale: The figure should illustrate only those sample locations that are known prior to the beginning of field work.

RESPONSE

The text and figures have been modified as requested.